

No Calculators!!!

Solve each exponential equation.

1. $7^{3x+5} = 7^{x-3}$ $3x+5 = x-3$ $2x = -8$ $x = -4$	2. $10^{3x+5} = 10^{x-3}$ $3x+5 = x-3$ $2x = -8$ $x = -4$
3. $\left(\frac{1}{7}\right)^x = 7^{x+4}$ $7^{-x} = 7^{x+4}$ $-x = x+4$ $-2x = 4$ $x = -2$	4. $2^x = 8$ $2^x = 2^3$ $x = 3$
5. $3^{x+5} = 9^2$ $3^{x+5} = (3^2)^2$ $x+5 = 4$ $x = -1$	6. $\left(\frac{1}{2}\right)^{x+4} = 8^{x-1}$ $(2^{-1})^{x+4} = (2^3)^{x-1}$ $-x-4 = 3x-3$ $-1 = 4x$ $-\frac{1}{4} = x$
7. $8^{7x} = 16^{3x+9}$ $(2^3)^{7x} = (2^4)^{3x+9}$ $21x = 12x+36$ $9x = 36$ $x = 4$	8. $27^{7x} = 81^{3x+9}$ $(3^3)^{7x} = (3^4)^{3x+9}$ $21x = 12x+36$ $9x = 36$ $x = 4$

Evaluate *without using a calculator!*

(Hint: Set each expression equal to x. Rewrite as an exponential equation and solve like above!)

9. $\log_8 2$ $8^x = 2$ $2^{3x} = 2^1$ $3x = 1$ $x = \frac{1}{3}$	10. $\log_7 1 = 0$	11. $\log 0.01$ $10^x = \frac{1}{100}$ $10^x = 10^{-2}$ $x = -2$
12. $\log_3 \frac{1}{81}$ $3^x = \frac{1}{81}$ $3^x = 3^{-4}$ $x = -4$	13. $\log_{\frac{1}{2}} 8$ $\frac{1}{2}^x = 8$ $2^{-x} = 2^3$ $x = -3$	14. $\log_4 2$ $4^x = 2$ $2^{2x} = 2^1$ $x = \frac{1}{2}$
15. $\log_m m^3$ $m^x = m^3$ $x = 3$	16. $\log_{27} 9$ $27^x = 9$ $3^{3x} = 3^2$ $x = \frac{2}{3}$	17. $\log_3 243$ $3^x = 243$ $3^x = 3^5$ $x = 5$
18. $\log_{\frac{1}{16}} \frac{1}{8}$ $\frac{1}{16}^x = \frac{1}{8}$ $2^{-4x} = 2^{-3}$ $-4x = -3$ $x = \frac{3}{4}$	19. $\log \sqrt{1000}$ $10^x = \sqrt{10^3}$ $10^x = 10^{\frac{3}{2}}$ $x = \frac{3}{2}$	20. $\ln e^7$ $e^x = e^7$ $x = 7$
21. $\log_3 3^4$ $3^x = 3^4$ $x = 4$	22. $\log_{15} 1 = 0$	23. $\log_2 \frac{1}{16}$ $2^x = \frac{1}{16}$ $2^x = 2^{-4}$ $x = -4$
24. $\log_{\frac{1}{3}} 27$ $\frac{1}{3}^x = 27$ $3^{-x} = 3^3$ $x = -3$	25. $\log_9 9 = 1$	26. $\log_8 4$ $8^x = 4$ $2^{3x} = 2^2$ $3x = 2$ $x = \frac{2}{3}$

Solve for x.

(Hint: Rewrite as an exponential equation and solve like above!)

<p>27. $\log_{\frac{1}{2}} 16 = x$</p> $\frac{1}{2}^x = 16$ $2^{-x} = 2^4$ $-x = 4$ $\boxed{x = -4}$	<p>28. $\log_5 x = -2$</p> $5^{-2} = x$ $\frac{1}{5^2} = x$ $\boxed{x = \frac{1}{25}}$
<p>29. $\log_m \frac{1}{27} = -3$</p> $m^{-3} = \frac{1}{27}$ $m^{-3} = 3^{-3}$ $\boxed{m = 3}$	<p>30. $\log_x \sqrt[3]{7} = \frac{1}{3}$</p> $x^{\frac{1}{3}} = \sqrt[3]{7}$ $x^{\frac{1}{3}} = 7^{\frac{1}{3}}$ $\boxed{x = 7}$
<p>31. $\log_{\frac{1}{2}} x = -6$</p> $\left(\frac{1}{2}\right)^{-6} = x$ $2^6 = x$ $\boxed{x = 64}$	<p>32. $\log_{64} 8 = x$</p> $64^x = 8$ $8^{2x} = 8^1$ $2x = 1$ $\boxed{x = \frac{1}{2}}$

Answers:

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|------------------|-------------------|-------------------|--------------------|--------|-------------------|--------|-------------------|
| 1) -4 | 2) -4 | 3) -2 | 4) 3 | 5) -1 | 6) $-\frac{1}{4}$ | 7) 4 | 8) 4 |
| 9) $\frac{1}{3}$ | 10) 0 | 11) -2 | 12) -4 | 13) -3 | 14) $\frac{1}{2}$ | 15) 3 | 16) $\frac{2}{3}$ |
| 17) 5 | 18) $\frac{3}{4}$ | 19) $\frac{3}{2}$ | 20) 7 | 21) 4 | 22) 0 | 23) -4 | 24) -3 |
| 25) 1 | 26) $\frac{2}{3}$ | 27) -4 | 28) $\frac{1}{25}$ | 29) 3 | 30) 7 | 31) 64 | 32) $\frac{1}{2}$ |

Here is a sneak peek at what we are aiming for ...

a) If $2^x = 8$ yields $x = 3$ and $2^x = 16$ yields $x = 4$, what would $2^x = 10$ yield?
(You do NOT have to be exact ... just approximate.)

$$3 < x < 4$$

b) If you were to solve $5^x = 37$ (which you eventually will know how to do!),
 x would be between what two whole numbers?

$$2 < x < 3$$